POLICY STATEMENT

The Florida Native Plant Society opposes the agricultural production of *Arundo donax* (giant reed, e-grass, bamboo reed, arundo grass, giant bamboo reed, etc.) as a biofuel in Florida due to its invasive characteristics and empirical evidence of impact on native plant communities. The Society further encourages the eradication of existing stands of this species and the banning of its sale as an ornamental to prevent invasion of native plant habitats in Florida.

BACKGROUND

Arundo donax is a large, clumping grass species native to the Indian subcontinent and possibly to adjacent areas of Asia and eastern Europe. It has been spread across most tropical to warm-temperate regions of the globe for various reasons including but not limited to ornamental horticulture, erosion control reed production for musical instruments, thatch, biomass production (biofuel), and building materials.

Outside its native range, *Arundo donax* is believed to be sterile or nearly sterile and most if not all reproduction is by fragmentation of rhizomes and production of new roots from stems at nodes (Dudley, undated). It is found primarily in riverine habitats where it is broken up and spread during high water events (Else, 1996 as cited in Dudley, undated) and where, once introduced, it spreads vegetatively forming large, dense masses. A single clone can cover hundreds of acres (Pacific Island Ecosystems at Risk, 2005). Spread between riverine systems is rarely addressed in the literature with 1) rare viable seed, 2) movement on equipment, 3) deliberate introduction by humans, 4) and occasional movement of plant fragments by animals or humans being known or hypothesized. That it does spread is certain, and *Arundo donax* is listed as one of the 100 most invasive species by The Invasive Species Specialist Group (ISSG**)** a specialist group of the Species Survival Commission (SSC) of the World Conservation Union (IUCN) (Lowe et al., 2000).

Arundo donax is considered to be invasive in much of its introduced range including all or parts of Australia (Auld and Meld, 1987; Dudley, 2005; The Nature Conservancy, 2004), New Zealand (Biosecurity New Zealand, 2006), Thailand, South Africa (Gibbs Russell *et al*., 1990), Mexico (Hendrickson and McGaugh (2005), various Pacific Islands (PIER), Bahamas (Correll and Correll, 1982), Bermuda (Kairo et al., undated), Dominican Republic (Kairo et al., undated), Haiti (Kairo et al., undated), parts of Southern Europe (Ferreira & Moreira, 1995), and the United States. Other countries where it is found have no invasive species reporting or control programs and/or the species may be considered to be potentially native. These include much of S.E. Asia, China, and most of Africa. In the United States, it is considered extremely damaging in California and Hawaii. It is noted as invasive or a serious risk in Texas (McWilliams, 2004; Owens et al., 2005; Texas Administrative Code), New Mexico, Nevada, Oregon, Virginia (VDCR and VNPS, 2003), Alabama (Alabama Invasive Plant Council)

where it is found in coastal counties, South Carolina (SC EPPC), and Tennessee (McWilliams, 2004; TEPPC, 2004). It is listed as potentially invasive in Georgia (GEPPC, 2006) because it is invasive in adjacent states. Other states (North Carolina, Mississippi) have occurrence records that suggest it may be colonizing major riverine systems but not at this time reported as a specific problem (some of these states appear not to maintain lists of invasive species) (SE EPPC, 2006). Some of the problem areas are similar to Florida in climate and soils.

Arundo donax is present in Florida, but it is not currently classified as being invasive. It is not listed on the 2005 Florida Exotic Pest Plant Council list of invasive species. It is, however, reported growing outside of cultivation in 23 of the 67 counties in the state, and its distribution covers the entire state excluding the keys (Wunderlin and Hansen, 2006). Anecdotal references suggest that, in general, ornamental plantings of giant reed in the Southeast have not been highly invasive. However, localized and scattered infestations of giant reed are present across the Southeast and the invasive potential, especially with added sources of introduction, is unknown (Loewenstein, undated).

Arundo donax has invaded native plant communities in several parts of Florida, including Anastasia State Park where an eradication program is in place (FDEP, 2004), Washington Oaks Gardens State Park, the banks of the St. Johns River where it is reported growing near and possibly threatening the endangered Okeechobee gourd (Ward and Minno, 2002), parts of Merritt Island, and the shore of Lake Munson in Tallahassee. Garland (2006) observed colonies of giant cane along a power line right-of-way adjacent to the Banana River and hypothesized that they were probably being spread by ground-clearing equipment under the power line (Garland, 2006). The best known location is probably at Washington Oaks Gardens State Park. As reported by Garland (2006), J. B. Miller, District Biologist, Florida Park Service, has observed isolated plants in Washington Oaks Gardens State Park that appear not to have arisen from rhizomes. If this is an indication of sexual reproduction in Florida, there may be a greater risk of potential invasion than has here-to-fore been assumed.

Garland (2006) provided a report to a proposed grower of “e-grass” a.k.a. *Arundo donax* apparently to demonstrate that the growing of *Arundo donax* would not cause a threat to the ecosystems (and economy?) of Florida. In his report, he hypothesizes that the species spreads only slowly in the absence of mechanical disturbance and concludes that the risk of planting *Arundo donax* as a biofuel in Florida is only low to moderate. The above compilation of occurrences of *Arundo donax* in the southeast, Caribbean, and Florida suggests that this categorization might be “optimistic.”

Garland’s report is almost exclusively a literature review, and the only Florida-specific information comes from Wunderlin and Hansen (2003), a biologist at Washington Oaks Gardens State Park, and himself. In both the latter cases, the species has managed to propagate beyond any intentional plantings. His specific assessment of planting 8,000 acres as a biofuel plant is conditioned by

the following:

1. The greatest risk will be mechanical fragmentation of the rhizomes and stems and their unintentional dispersal in trash or earth.

2. If a large planting were (1) isolated from wetlands, rivers, canals, and coastlines and (2) carefully managed to avoid unintentional spread of the rhizomes and stems

Only with these caveats does he conclude that “then I believe the risk of such a planting to Florida’s native ecosystems would be low. “

The conclusion by Mark Garland appears to be flawed for several reasons:

1. It is not clear where in Florida one finds 8,000 acres (or 15,000 acres as suggested by another source) where there are no wetlands or wet conveyance systems. Many of the California “streams” occupied by *Arundo donax* closely resemble deeply incised ditches such as the agricultural drainage ditches present throughout poorly drained agricultural areas in Florida. The entire region near Lake Okeechobee, suggested as a potential area for growing *Arundo donax,* is crisscrossed by ditches or “canals.” Highlands and DeSoto Counties have also been suggested as Arundo donax production sites. Except for the Lake Wales Ridge in Highlands County, both Highlands and DeSoto counties are characterized by low rangeland with drainage ditches.

2. One of the stated reasons for “low risk” is that *Arundo donax* has been present in Florida for over 100 years without becoming a major pest. *Arundo donax* was also present in California for over 100 years before it became a pest. In California, it was reported to be present from the early 1800’s with at least one reference indicating an even earlier introduction date. It became noted as a serious pest only within the last 25 years. It has been hypothesized that this was driven by a program in the 1950’s that encouraged the planting of this species for erosion control. Ironically, one of the issues today is that it actually accelerates streambank erosion. Only when there was more than a trivial amount of the species did a problem occur. Other invasive species have also been shown to have a substantial lag time occurring before the species becomes problematic. 8,000 or 15,000 acres of *Arundo donax* is far more than the trivial isolated, mostly horticultural, mostly far-from-wetlands clumps of *Arundo* currently typical in Florida, and a massive increase in species occurrence could provide ample opportunities for inadvertent spread. Grevstad (2000) also points out that substantial delays in invasion may come from patterns in habitat diversity combined with limitations on propagules, a model that could

be applicable to *Arundo donax* with limitations imposed by its supposed lack of sexual reproduction.

3. "Giant reed is a C3 plant, yet it displays the unsaturated photosynthetic potential of C4 plants, and is capable of extremely high photosynthetic rates (Papazoglou et al., 2005). This, in combination with high water use and relatively good water use efficiency result in giant reed being one of the most productive plant species in the world, growing up to 10 cm per day under optimal conditions (Perdue, 1958; Bell, 1987; Newhouser et al., 1999). As a result, the potential to out compete neighboring plants is quite high." (Loewenstein, undated). This growth potential rate is both what makes *Arundo donax* attractive as a biofuel and also much of what gives it invasive potential.

4. *Arundo donax* currently found in Florida is at least predominantly a cultivar selected for its striped leaves which are attractive when young (*Arundo donax* var. *versicolor*) (FEIS, undated). A cultivar chosen for rapid growth could be substantially more difficult to contain or control if it should escape.

5. The risk goes beyond mere escape. Garland states a cost of $5000 to $17000 per acre for eradication in California and notes the problem of control if the site is abandoned based on California estimates. The cost could actually be considerably greater for multiple reasons.

   The most current proposal appears to focus on Highlands and DeSoto Counties as the location for the proposed biofuel cultivation. A previous proposal was for the cultivation to occur near Lake Okeechobee. Both are risky, but of the two, cultivation near Lake Okeechobee is worse. If the species were to escape into natural waterways, it would likely get into Lake Okeechobee and then the Kissimmee River, Caloosahatchee River, and the eastern outlet canal from Lake Okeechobee. The risk of contaminating the Everglades would be substantial.

   Highlands and DeSoto counties are not isolated from natural waterways, and almost all potential growing areas would require either substantial irrigation or would be close to natural waterways. Lake Istokpoga and Fisheating Creek both drain toward Lake Okeechobee and carry the risks suggested above. Drainages in DeSoto County are to the west and could pose risks to the Peace River.

   The consequences for the fishing and tourism industries could be astronomical and are not included in the risk assessment. Among its charms, *Arundo donax* is known to be destructive to fish and amphibian habitat (Dudley, undated; Dudley and Collins, 1995; Bell,

2003), attract Norway rats, be extremely flammable (FEIS, 2006), cause erosion, and seriously harm or eliminate habitat for rare species. Garland did not evaluate the potential for it to invade a largely wetland area such as the Everglades and Big Cypress Swamp. Garland did not address effects on wildlife or fisheries if this plant should escape. Potential losses in recreational revenues were not assessed.

6. Garland does not assess secondary effects. *Arundo donax* is noted for tolerating a very wide range of conditions, but the rapid growth needed to make it a valued biofuel requires both water and fertilizer. Limited studies are available, but one estimate of water usage is 2000 L/m^2 per crop (Iverson 1994); in the Santa Ana valley where in 2001 there were approximately 10,000 acres of *Arundo*, it was estimated to waste 30,000 acre-feet (9.8 billion gallons) of water every year (Team Arundo, 2002). With this water usage, either major pumping of ground or surface water would be required in addition to rainfall in the average year. One can expect impacts to the aquifer unless this replaces a consumptive water use of equivalent magnitude. If a surface water body is the source, or the area is one of high ground water, other issues arise. In the latter case, the site is likely wet enough for the plant to simply escape without needing a "wetland."

7. Before approval of such a species is contemplated, the full range of impacts should be addressed. This analysis should be "arms length," that is, conducted by an independent reviewer not funded by the organization proposing to plant the species.

Greener Magazine (Weikle, 2006) asked Allen Sharpe (whose company, Biomass Inc., requested Mark Garland to conduct his assessment) if non-native grass posed any threat to Florida's fragile environment, he replied that the company had been, "a good steward" during the planning stage in asking the Florida Division of Plant Industry to evaluate *Arundo donax*. It appears likely that the analysis done by Mark Garland was actually conducted to enable the proposed agricultural enterprise to avoid several conditions of **581.083 F.S.,** which is the Florida statute intended to protect Florida against new invasions due to the large-scale planting of species that could pose escape risks, specifically

> 4) A person may not cultivate a nonnative plant, including a genetically engineered plant or a plant that has been introduced, for purposes of fuel production or purposes other than agriculture in plantings greater in size than 2 contiguous acres, except under a special permit issued by the department through the division, which is the sole agency responsible for issuing such special permits. Such a permit shall not be required if the department determines, in conjunction with the Institute of Food and Agricultural Sciences at the University of Florida, that the plant is not invasive and subsequently exempts the plant by rule.
>
> (a)1. Each application for a special permit must be accompanied by a fee as described in subsection (2) and proof that the applicant has obtained a bond in the form approved by the department and issued by a surety company admitted to do business in this state or a certificate of

> deposit. The application must include, on a form provided by the department, the name of the applicant and the applicant's address or the address of the applicant's principal place of business; a statement completely identifying the nonnative plant to be cultivated; and a statement of the estimated cost of removing and destroying the plant that is the subject of the special permit and the basis for calculating or determining that estimate. If the applicant is a corporation, partnership, or other business entity, the applicant must also provide in the application the name and address of each officer, partner, or managing agent. The applicant shall notify the department within 10 business days of any change of address or change in the principal place of business. The department shall mail all notices to the applicant's last known address.

And later in the same section

> (e) Each permitholder shall maintain for each separate growing location a bond or a certificate of deposit in an amount determined by the department, but not less than 150 percent of the estimated cost of removing and destroying the cultivated plants. The bond or certificate of deposit may not exceed $5,000 per acre, unless a higher amount is determined by the department to be necessary to protect the public health, safety, and welfare or unless an exemption is granted by the department based on conditions specified in the application which would preclude the department from incurring the cost of removing and destroying the cultivated plants and would prevent injury to the public health, safety, and welfare.

Based on the risks noted above and upon the extreme costs of controlling *Arundo donax* where it becomes invasive, Florida should either forbid the growing of *Arundo donax* as a biofuel, or at a minimum, apply the existing regulations that are designed to protect the ecology and economy of Florida from risky agricultural enterprises involving invasive or potentially invasive species.

Based on a very real risk, the absolute minimum bond which should be applied is $7500/acre (1.5 times the minimum eradication cost estimate) or $60,000,000 for an 8,000 acre site.

When consulted by FNPS member Ray Wunderlich, the FDEP representative suggested that they were satisfied with Mark Garland's analysis unless it was demonstrated that the plant WOULD cause harm. The better analysis is that an enterprise that proposes to plant a species that is potentially invasive should demonstrate that it WILL NOT cause harm. The Garland report does not demonstrate that *Arundo donax* will not be invasive. In fact, the report is carefully written to suggest a low potential for invasion ONLY if a series of difficult-or-impossible-to-meet conditions (such as not being planted near wetlands or canals) are imposed.

At a minimum, this agricultural enterprise should be required to post the bond that is intended in **581.083 F.S.** to protect against the very kinds of environmental disasters that could arise from an enterprise of the proposed type.

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